Online Appendix for "Kill Zone"

A1. Proofs

A1.1 Proof of Theorem 2:

Let $\Delta E_0[\Pi^E(\theta)] = E_0^{NM}[\Pi^E(\theta)] - E_0^M[\Pi^E(\theta)]$ denote the differential of the expected profits for the entrant when mergers are prohibited and when mergers are not prohibited.

For any θ, the entrant's expected profit at $t=0$ depends on the app designers' quality expectation, q. Suppose $f(q)$ be the probability density function of *q*. The entrant's expected profits are as follows:

$$E_0^{NM}[\Pi^E(\theta)] = \int_q V^E(p^{NM},q) f(q)\,dq$$

$$E_0^M[\Pi^E(\theta)] = \int_q \Big[\mu V^E(p^M,q) + (1-\mu)\Big(V(1) - V^I(1-p^M,q)\Big)\Big] f(q)\,dq$$

Now, the differential of the expected profits $\Delta E_0[\Pi^E(\theta)]$ is given by

$$\Delta E_0[\Pi^E(\theta)] = \int_q \Big[V^E(p^{NM},q) - \mu V^E(p^M,q) - (1-\mu)\Big(V(1) - V^I(1-p^M,q)\Big)\Big] f(q)\,dq$$

It can be observed that $\Delta E_0[\Pi^E(\theta)]$ is continuous in $\mu \in [0,1]$ and increasing in μ.

$$\frac{d\Delta E_0[\Pi^E(\theta)]}{d\mu} = \int_q \Big[-V^E(p^M,q) + \Big(V(1) - V^I(1-p^M,q)\Big)\Big] f(q)\,dq$$

$$\frac{d\Delta E_0[\Pi^E(\theta)]}{d\mu} = \int_q \Big[V(1) - V^I(1-p^M,q) - V^E(p^M,q)\Big] f(q)\,dq$$

Since $V(1) > V^I(1-p^M,q) + V^E(p^M,q)$ (see section 3.3), we have $\frac{d\Delta E_0[\Pi^E(\theta)]}{d\mu} > 0$.

For $\mu = 1$, the incumbent has all the bargaining power.

$$\Delta E_0[\Pi^E(\theta)]\big|_{\mu=1} = \int_q \Big[V^E(p^{NM},q) - V^E(p^M,q)\Big] f(q)\,dq.$$

$$\Delta E_0[\Pi^E(\theta)]\big|_{\mu=1} = E_0\Big[V^E(p^{NM})\Big] - E_0\Big[V^E(p^M)\Big]$$

From section 3.3, $E_0\left[V^E(p^{NM})\right] \geq E_0\left[V^E(p^M)\right]$ with equality holding when none of the app designers switch. When atleast a fraction of app designers switch, $E_0\left[V^E(p^{NM})\right] > E_0\left[V^E(p^M)\right]$.

Hence $\Delta E_0[\Pi^E(\theta)]|_{\mu=1} > 0$.

For $\mu = 0$: The entrant has all the bargaining power.

$$\Delta E_0[\Pi^E(\theta)]|_{\mu=0} = \int_q \left[V^E(p^{NM},q) - \left(V(1) - V^I(p^M,q)\right)\right] f(q)\,dq$$

If $V^E(p^{NM},q) \geq \left(V(1) - V^I(p^M,q)\right)$, then $\Delta E_0[\Pi^E(\theta)]|_{\mu=0} \geq 0$ and the theorem 2 is trivially proved with $\hat{\mu} = 0$. If $V^E(p^{NM},q) \leq \left(V(1) - V^I(p^M,q)\right)$, then $\Delta E_0[\Pi^E(\theta)]|_{\mu=0} \leq 0$ and by Intermediate Value Theorem (since $\Delta E_0[\Pi^E(\theta)]$ is continous and increasing in μ) with $\Delta E_0[\Pi^E(\theta)]|_{\mu=0} \leq 0$ and $\Delta E_0[\Pi^E(\theta)]|_{\mu=1} > 0$, there exist a $\hat{\mu} \in [0,1]$ such that $\Delta E_0[\Pi^E(\theta)] = 0$.

Therefore, for the incumbent bargaining power $\mu > \hat{\mu}$, the differential $\Delta E_0[\Pi^E(\theta)] > 0$ i.e.,

$$E_0^{NM}[\Pi^E(\theta)] > E_0^M[\Pi^E(\theta)]$$

This implies that the range of C^E that are viable is higher when mergers are prohibited than when they are not and hence there is a higher probability of the new platform entering when mergers are prohibited than when they are not.

A2. Comparative Statics

In this section, we present the detailed comparative statics for the section 4.

A2.1 Network Externalities

Consider the modified form of equation $S(\rho) = 0$:

$$\rho^* + \zeta\left(2 + \frac{(1+m)\lambda q}{\bar{s}} - (1+\lambda) - 2\Phi\left(\gamma\left(\rho^* - q\right)\right)\right) = 0.$$

Now, the effect of ζ on ρ^* is given by $\dfrac{d\rho^*}{d\zeta} = \dfrac{\rho^*}{\zeta\left(1 - \zeta(2\gamma)\phi\left(\gamma\left(\rho^* - q\right)\right)\right)}$

which gives $\frac{d\rho^*}{d\zeta} > 0$ for $\rho^* > 0$ and $\frac{d\rho^*}{d\zeta} < 0$ for $\rho^* < 0$.

It is straight-forward to see that as ζ decreases from one to zero, ρ^* tends to zero. i.e., for a given app designers' expectation of quality, the optimal switching point decreases if it is greater than zero and increases if it is less than zero. Also, we have $\rho^* = 0$if $\zeta = 0$.

Now let us see the change in the effect of 'm' and 'q' on ρ^* because of a decrease in ζ. We have

$$\frac{d\rho^*}{dm} = \frac{-\frac{\zeta\lambda q}{\bar{s}}}{\left(1-\zeta(2\gamma)\phi\left(\gamma\left(\rho^*-q\right)\right)\right)} < 0 \text{and } \frac{d\rho^*}{dq} = 1 - \frac{1+\frac{\zeta(1+m)\lambda}{\bar{s}}}{\left(1-\zeta(2\gamma)\phi\left(\gamma\left(\rho^*-q\right)\right)\right)} < 0$$

As ζ decreases from one to zero, the magnitudes of $\frac{d\rho^*}{dm}$ and $\frac{d\rho^*}{dq}$decreases and hence number of ordinary customers switching increases at a lower rate compared to the case $\zeta = 1$ as '*m*' or '*q*' increases. Also, if $\zeta \to 0$, the effect of both '*m*' and '*q*' on ρ^* vanishes.

A2.2 Network externalities of app designers:

In this section we see the effect of no network externalities of app designers for ordinary customers and to see this, it makes sense to study what happens when λ falls to zero.

$$\frac{d\rho^*}{d\lambda} = \frac{-\frac{(1+m)q}{\bar{s}}+1}{\left(1-(2\gamma)\phi\left(\gamma(\rho^*-q)\right)\right)}$$

$$\Rightarrow \quad \frac{d\rho^*}{d\lambda} > 0 \text{ if } q < \frac{\bar{s}}{(1+m)} \quad \text{and} \quad \frac{d\rho^*}{d\lambda} < 0 \text{ if } q > \frac{\bar{s}}{(1+m)}$$

The effect of the measure of app designers λ on the switching point varies with the level of public signal. If the app designer expectation of quality is relatively high, then the optimal switching point ρ^* increases as the measure of app designers, λ, decreases. Intuitively, with a relatively high expectation of quality from the app designers, the ordinary customers willing to switch is relatively higher and then the decrease in the network externalities from app designers negatively impacts the switching decision of the ordinary customers.

Now let us see the change in the effect of 'm' on ρ^* because of a decrease in λ. We have

$$\frac{d\rho^*}{dm} = \frac{-\frac{\lambda q}{\bar{s}}}{\left(1-(2\gamma)\phi\left(\gamma(\rho^*-q)\right)\right)} < 0 \quad \text{and} \quad \frac{d\gamma}{d\alpha} > 0; \ \frac{d\phi}{d\gamma} < 0$$

If λ decreases, the magnitude of $\frac{d\rho^*}{dm}$ decreases. Hence, the rate at which the number of periods 'm' affects ρ^* is reduced. If λ falls to zero, there is no effect of '*m'* on the optimal switching point. Intuitively, if there is no effect of techies then the ordinary customers rely on the signals and their externalities.

Now let us see the change in the effect of 'q' on ρ^* because of a decrease in λ. We have

$$\frac{d\rho^*}{dq} = 1 - \frac{1+\frac{(1+m)\lambda}{\bar{s}}}{\left(1-(2\gamma)\phi\left(\gamma\left(\rho^*-q\right)\right)\right)} < 0$$

If λ decreases, the magnitude of $\frac{d\rho^*}{dq}$ decreases. Hence, the rate at which the app designers' expectation of quality '*q*' affects ρ^* is reduced. Even if λ falls to zero, the effect of '*q*' on ρ^* persists but at a lower rate. Assuming that the ordinary customers can back out '*q*' (supposedly from a very small λ), the number of ordinary customers switching increases as '*q*' increases.

A2.3 Multi-homing vs Single-homing

Our baseline model assumed that the app designers can multi-home. Here we compare it to the case when they do not. Equation (1.2) now modifies to

$$\rho_i + p(\rho_i) + \frac{(1+m)\lambda q}{\bar{s}} \geq (1-p(\rho_i)) + \left(\lambda - \frac{(1+m)\lambda q}{\bar{s}}\right).$$

Now the optimal switching point in this case is given by

$$S'(\rho) = \rho + 2 + 2\frac{(1+m)\lambda q}{\bar{s}} - (1+\lambda) - 2\Phi(\gamma(\rho - q)) = 0$$

$$\text{i.e.,} \quad S'(\rho) = S(\rho) + \frac{(1+m)\lambda q}{\bar{s}} = 0$$

The difference between the two cases is just a constant multiplier '2' for the third term in the fundamental equation. Hence all the results of multi-homing model are unchanged for the case of single-homing. Let ρ_m^* and ρ_s^* denote the optimal swithcing point for multi-homing and single-homing respectively. Then we have

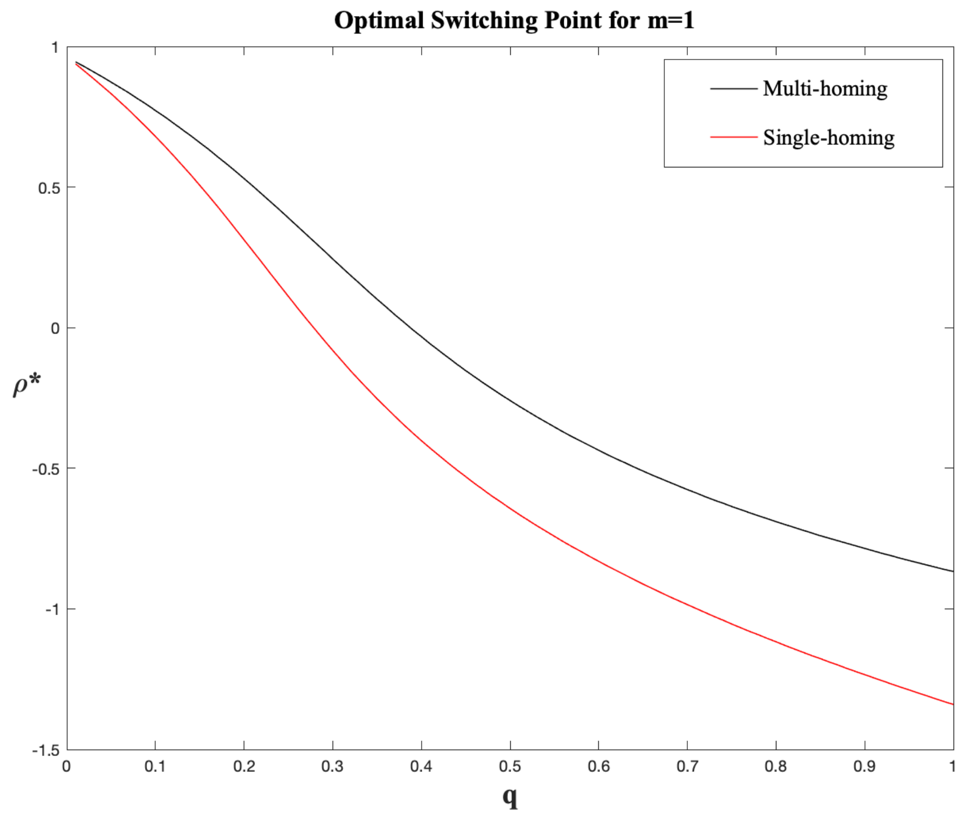
$$S'(\rho_s^*) = S(\rho_s^*) + \frac{(1+m)\lambda q}{\bar{s}} = 0 \quad \text{and} \quad S(\rho_m^*) = 0$$

From theorem 1, we have that $S(\rho)$ is increasing in ρ and the difference of above two equation yields

$$S(\rho_s^*) - S(\rho_m^*) = -\frac{(1+m)\lambda q}{\bar{s}} < 0$$

$$\Rightarrow \rho_s^* < \rho_m^*$$

The optimal switching point for the ordinary customers is lower for the case of single-homing and so the proportion of ordinary customers switching is higher when the app designers are completely dedicated to improving the new platform. The following figure presents this result comparing the case of multi-homing and single-homing for $m = 1$, $\lambda = 0.4$, $\bar{s} = 2$, $\alpha = 300$, $\beta = 100$, $\theta \in [0,1]$



Optimal Switching Point for m=1
Multi-homing
Single-homing
1
0.5
0
-0.5
-1
-1.5
ρ*
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
q

A3. Tables

Table 3 OA. Post-Acquisition Decline in Normalized Investments and Deals

The dependent variable in the columns (1) and (2) is the amount of VC investments in startup companies similar to the acquired one divided by all VC investments in early-stage deals in the software industry (which is the relative investment) and further normalized by the relative investment in the year of the acquisition. The dependent variable in the columns (3) and (4) is the number of VC deals in companies similar to the acquired one divided by all VC early-stage deals in the software industry (relative number) and further normalized by the relative number in the year of the acquisition. In Panel A, a start-up is considered similar to the acquired company if it has a Pitchbook measure of similarity with the acquired company above 80%. In Panel B, a start-up is considered similar if it shares the same industry sector and vertical. Post acquisition is an indicator variable that is equal to 1 in the 3 years after the acquisition. t-statistics are reported in parentheses, * $p<0.10$, ** $p<0.05$, and *** $p<0.01$.

	Relative Investment (Normalized)		Relative # of Deals (Normalized)	
	(1)	(2)	(3)	(4)
Panel A: Pitchbook-based measure of similarity				
Post acquisition indicator	-0.318**	-0.314**	-0.292***	-0.305***
	(-2.20)	(-2.54)	(-2.73)	(-3.33)
Constant	1.088***	1.087***	1.086***	1.092***
	(9.29)	(12.36)	(14.15)	(17.26)
Acquisition Fixed Effects	No	Yes	No	Yes
Number of observations	60	60	60	60
Adjusted R^2	0.069	0.457	0.110	0.447
Panel B: Industry-based measure of similarity				
Post acquisition indicator	-0.371**	-0.371**	-0.278***	-0.278***
	(-2.21)	(-2.21)	(-2.97)	(-3.32)
Constant	1.161***	1.161***	1.112***	1.112***
	(7.36)	(7.75)	(14.03)	(18.05)
Acquisition Fixed Effects	No	Yes	No	Yes
Number of observations	63	63	63	63

Adjusted R^2	0.059	0.216	0.110	0.436